MOTOROLA

December 2, 1999

Ms. Magalie Roman Salas, Secretary
Federal Communications Commission
The Portals, TW-A325
445 12th Street, S.W.
Washington, D.C. 20554

Re: Ex Parte Notification – WT Docket No. 99-168

Dear Ms. Salas:

The attached letter is being filed on behalf of Motorola, Inc. (Motorola) and explains why -57 dBm is the maximum level of energy which should be deposited into the first 6.25 kHz channel of the 700 MHz Public Safety bands by the non-frequency coordinated CMRS base stations in that band. Please associate this letter in the file of WT Docket No. 99-168.

Introduction

Motorola presents here a discussion of one of the interference scenarios that needs to be considered by the FCC as part of its process to create rules for the commercial-use portion of the 746-806 MHz band. Specifically we will discuss the scenario which results from having commercial-use base station transmitters in spectrum immediately adjacent to the Public Safety mobile unit receive band.

At 764 MHz the commercial-use base transmit band is adjacent to the public safety mobile receive band. This has the potential to create coverage holes for public safety users in locations near the commercial-use base transmit sites. If public safety mobile units were to get close[1] to a site employing frequencies closely spaced from the desired band, the strong undesired base station transmitter signals would produce intermodulation products that would fall in the receive band of the public safety mobile receiver.[2] This would result in destructive interference to a normally strong desired public safety signal. In addition, side band noise from multiple sources can cause interference. This is what has been seen in the 800 MHz SMR band where CMRS

[1] Typically within a quarter to a half-mile.

[2] The most difficult type of this class of problem is receiver intermodulation (IM) where the IM products are generated in the victim receiver. Increasing receiver IM performance is not easy as it increases the cost of the receiver and consumes additional battery power. This makes the radios larger, heavier, and more costly.

systems are intermingled in the same band with public safety systems. Public Safety mobile units operating in close proximity to an interfering CMRS site cannot receive relatively strong desired signals. This identical configuration occurs between the 866-869 MHz public safety mobile receive band and the 869-894 MHz cellular base transmit band. And, indeed, this same interference scenario occurs at the band interface at 869 MHz where cellular sites can create dead zones around them for public safety systems. The presence of continuous high power carriers from these base stations makes this a high probability occurrence.

In order to understand how to mitigate this problem, Motorola begins with the receiver of a typical Public Safety radio. The noise floor of such a receiver with approximately a 6 kHz bandwidth and typical noise figure of 10 dB is approximately

$$-144 + 10 \text{ Log } 6 + 10 = -126 \text{ dBm.}$$

In order to maintain public safety communications capability, the noise floor of this receiver should be degraded by only about 1 dB as a result of interference from a commercial-use base station. This requires that the interference into the Public Safety receiver must be 6 dB below the receiver noise floor, or -132 dBm, as can be seen from the following expression.

$$10^{(-126/10)} + 10^{(-132/10)} = 3.14 \times 10^{-13} = -125.03 \text{ dBm.}$$

As can be seen, interference at this level is equivalent to a rise in the noise floor from -126 dBm to about -125 dBm.

The scenario we are considering here, as has been described above, is that of the commercial-use base station interfering into the Public Safety mobile. Therefore, there are two main components which determine the level of energy received by the Public Safety mobile unit from the commercial-use base station: out of band emission performance of the base station transmitter, and the path loss between the commercial use base station and the public safety mobile receiver. For the port-to-port path loss (from the input of the base antenna to the output of the subscriber antenna) in this case we consider 75 dB to be a representative number based on field tests. (We also refer to this path loss as "site isolation.") Measurements made of 17 different Nextel base sites in the Chicago area show that, at the 95% confidence level, the least path loss we can expect is about 75 dB, which at 600 to 1000 feet of separation. A plot of this data is shown in Figure 1.[3]

[3] See also, Garry C. Hess, Land Mobile Radio System Engineering, Artech House, 1993, page 16 for additional analysis which supports the result that 75 dB is a reasonable choice of value for path loss.

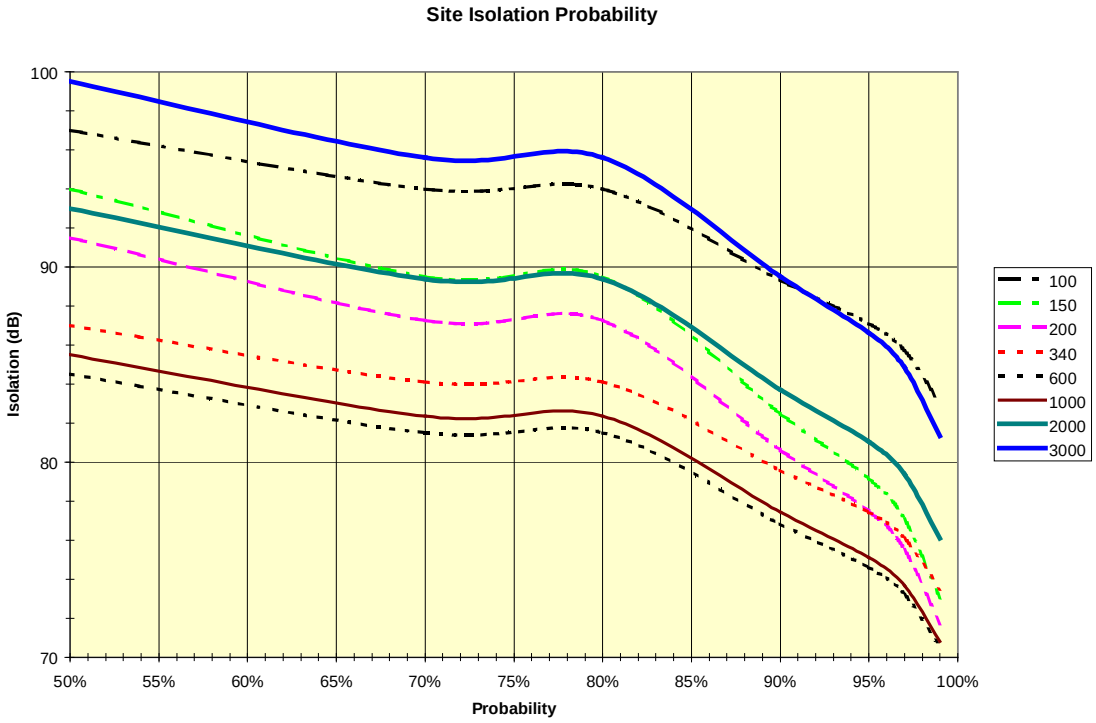

Figure 1: Path loss measurements made on 17 Nextel sites in the Chicago area

Once a reasonable value for the path loss has been determined, the maximum permissible energy deposited into the Public Safety receiver and the path loss together determine the out-of-band emission specification for the commercial-use base station transmitters.

Out-of-band emissions = Energy Received + Path Loss

or

Out-of-band emissions = -132 dBm + 75 dB = -57 dBm.

As mentioned above, this scenario has already been responsible for numerous occurrences of interference in the 800 MHz SMR band as well as in the 866 - 869 MHz public safety band. Using the value for path loss to the mobile units of 75 dB we find that the FCC's proposed out-of-band limits would result in interference levels around the site of approximately – 13 dBm – 75 dB = –88 dBm per source from the base transmitters. This is already quite high compared to the -132 dBm that we have specified, and when reinforced by multiple sources and the potential for intermodulation products the situation will produce coverage dead spots around sites.

Finally, we wish to point out a recent submission to the FCC's National Coordination Committee by the Federal Law Enforcement Wireless Users' Group (FLEWUG).[4] In this submission FLEWUG proposes adjacent band emission limits to protect public safety receivers from yet-to-be determined transmitters in the 700 MHz band. The FLEWUG analysis states:

> To develop an interference protection limit for the public safety receivers in the 764-776/794-806 MHz bands a noise limited system will be assumed. A noise limited system is defined as one in which the performance is limited by the receiver noise level. In this case, the carrier-to-noise ratio (C/N) is only slightly greater than the minimum required for acceptable performance. In a noise-limited system, the interference level can be referred to the noise level and an interference-to-noise ratio (I/N) threshold can be used as the criterion for acceptable performance of the receiver. Since the threshold is based only on the noise level of the receiver the assumption of a noise limited system will result in a conservative interference protection limit that is somewhat independent of the receiver technology employed. A conservative approach is warranted because the services to be allocated in the spectrum adjacent to the public safety spectrum and their associated technical characteristics are unknown. Furthermore, the Notice of Proposed Rulemaking (NPRM)[5] and the legislative history[6] make it clear that in developing the rules for services that will operate in the 746-764 and 776-794 MHz bands, the Commission should ensure that public safety communications operating in the adjacent bands are not subject to interference from new services.

FLEWUG further bases its analysis on a requirement that " In order to protect public safety receivers in the 764-776/794-806 MHz bands a 1 dB increase in the receiver noise floor will be permitted. Using the equation for I/N threshold the 1 dB increase in the receiver noise floor results in an interference threshold of I/N_t = -6 dB. This means that the interference must be kept at least 6 dB below the noise level of the public safety receivers in the 764-776/794-806 MHz bands." FLEWUG calculates that the receiver noise power is approximately -128 dBm, so

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[4] *See* Letter to Kathleen Wallman, Chair of the National Coordination Committee, from Julio R. Murphy and Derek M. Siegle, Co-Chairmen of FLEWUG, dated November 17, 1999.

[5] *Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules*, Notice of Proposed Rulemaking, WT Docket No. 99-168 (released June 3, 1999) (hereinafter NPRM).

[6] Balanced Budget Act of 1997, Conference Report to Accompany H.R. 2015, 105th Cong., 1st Sess., Report 105-217, at 580 (July 30, 1997).

that the interference protection limit for Public Safety receivers should be -134 dBm. They also find that, for the base to mobile interference scenario 78.5 dB is an appropriate value for the propagation loss.

This independent analysis supports Motorola's conclusions and verify that, for the base-to-mobile interference situation, -57 dBm measured in the first 6.25 kHz channel of the public safety allocation is the appropriate level to allow for the out-of-band emissions from the non-coordinated commercial-use systems.

Please contact Leigh Chinitz at (202) 371-6940 regarding any questions concerning this matter.

Respectfully Submitted,

/s/ Leigh M. Chinitz
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cc:
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